



**NTSB** National Transportation Safety Board

# Aviation SMS

## Process:

## Transferable to

## Pipelines?

Presentation to:

PHMSA Pipeline Safety  
Management System Workshop

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# **Outline**

- **NTSB's SMS Recommendation**
- **Model for Organization-Level SMS**
- **External Issues**
  - **Role of the Regulator**
  - **Role of Manufacturers**

# NTSB Report, Marshall, MI (2012)

- Probable Cause: The rupture and prolonged release were made possible by *pervasive organizational failures* at . . . (Enbridge) that included the following:
  - Deficient integrity management procedures . . .
  - Inadequate training of control center personnel . . .
  - Insufficient public awareness and education . . .
- Finding No. 28. Pipeline safety would be enhanced if pipeline companies implemented safety management systems.
- Recommendation to API: Facilitate the development of a safety management system standard specific to the pipeline industry that is similar in scope to your Recommended Practice 750, Management of Process Hazards.

# Safety Issues in Complex Systems

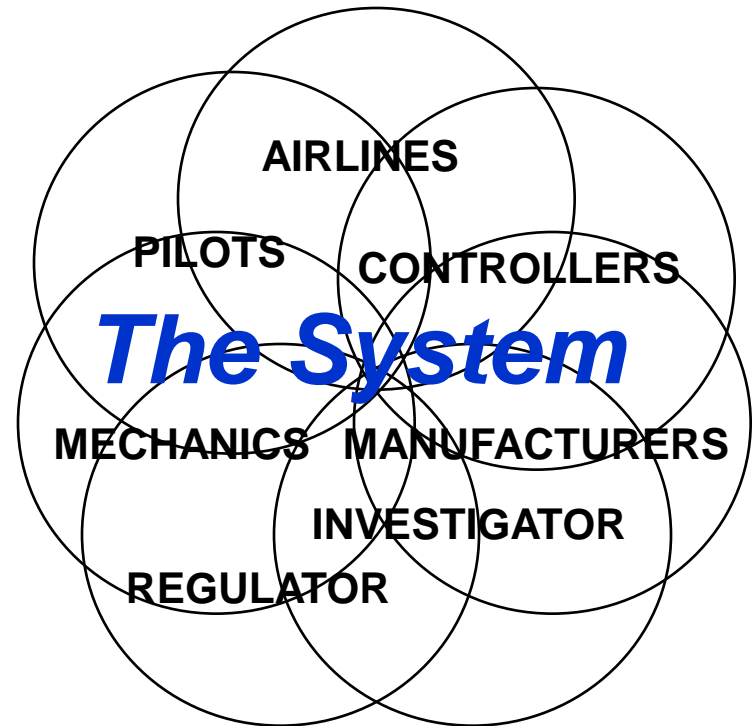
- **More System**

- Interdependencies***

- Large, complex, interactive system
    - Often tightly coupled
    - Hi-tech components
    - Continuous innovation
    - Ongoing evolution

- **Safety Issues Are More Likely to Involve**

- Interactions Between Parts of the System***



# Effects of Increasing Complexity:

## **More** “Human Error” Because

- **System More Likely to be Error Prone**
- **Operators More Likely to Encounter Unanticipated Situations**
- **Operators More Likely to Encounter Situations in Which “By the Book” May Not Be Optimal (“workarounds”)**



# The Result:

## Front-Line Staff Who Are

- Highly Trained
- Competent
- Experienced,
- Trying to Do the Right Thing, and
- Proud of Doing It Well

**. . . Yet They Still Commit**

**Inadvertent  
Human Errors**

# **The Solution: System Think**

***Understanding how a  
change in one subsystem  
of a complex system may  
affect other subsystems  
within that system***

# **“System Think” via Collaboration**

**Bringing all parts of a complex system together to collaboratively**

- **Identify potential issues**
- ***PRIORITIZE* the issues**
- **Develop solutions for the prioritized issues**
- **Evaluate whether the solutions are**
  - **Accomplishing the desired result, and**
  - **Not creating unintended consequences**



# When Things Go Wrong

## How It Is Now . . .

You are highly trained

*and*

If you did as trained, you  
would not make mistakes

so

You weren't careful  
enough

so

You should be **PUNISHED!**

## How It Should Be . . .

You are human

*and*

Humans make mistakes

so

Let's *also* explore why the  
system allowed, or failed to  
accommodate, your mistake

*and*

Let's **IMPROVE THE SYSTEM!**

# Fix the Person or the System?

Is the **Person**  
*Clumsy?*

Or Is the  
Problem . . .

The **Step???**



# **Enhance Understanding of Person/System Interactions By:**

- Collecting,**
  - Analyzing, and**
  - Sharing**
- # **Information**

# Objectives:

**Make the System**

***(a) Less  
Error Prone***

**and**

***(b) More  
Error Tolerant***

# Aviation Industry-Wide Success

**83% Decrease** in Fatal Accident Rate,  
1997 - 2007

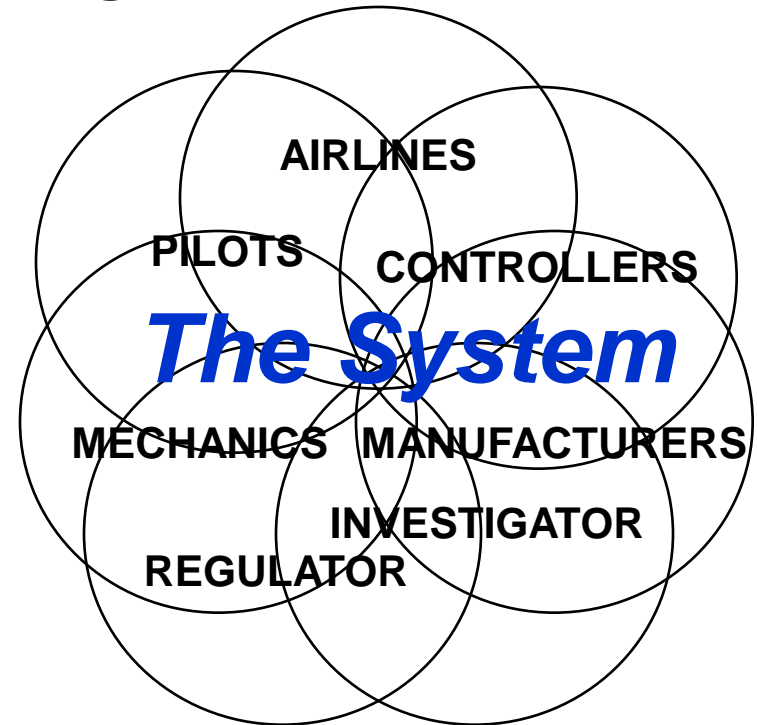
largely because of  
***System Think***

fueled by  
***Proactive Safety  
Information Programs***

P.S. Not only did the process improve safety, it also  
improved productivity!

# Aviation “System Think” Process

- Engage All Participants In Identifying Problems and Developing and Evaluating Remedies
- Airlines
- Manufacturers
  - *With the systemwide effort*
  - *With their own end users*
- Air Traffic Organizations
- Labor
  - *Pilots*
  - *Mechanics*
  - *Air traffic controllers*
- Regulator(s) [Query: Investigator(s)?]





# Moral of the Story

Anyone who is  
involved in the *problem*  
should be  
involved in the *solution*

# **Collaboration: A Major Paradigm Shift**

- **Old: Regulator identifies a problem and proposes solutions**
  - Industry skeptical of regulator's understanding of the problem
  - Industry resists regulator's solutions and/or implements them begrudgingly
- **New: Collaborative “System Think”**
  - Industry involved in identifying problem
  - Industry “buy-in” re interventions because everyone had input, everyone's interests considered
  - Prompt and willing implementation
  - Interventions evaluated . . . *and tweaked as needed*
  - Solutions probably more effective and efficient
  - Unintended consequences much less likely



# Challenges of Collaboration

- Human nature: “I’m doing great . . . *the problem is everyone else*”
- Differing and sometimes competing interests
  - Labor-management issues
  - May be potential co-defendants
- Regulator probably not welcome
- Not a democracy
  - Regulator must regulate
- Requires all to be willing, in their *enlightened self-interest*, to leave their “comfort zone” and think of the System



# **System Think at Other Levels?**

- **“System Think” can be successful at any macro/micro level, including**
  - Entire industry
  - Company (some or all)
  - Type of activity
  - Facility
  - Team
- **Persistent workplace problem?**

# External Factors:

## The Regulator's Role

- Emphasize the importance of System issues *in addition to* (not instead of) worker issues
- Encourage and participate in industry-wide “System Think”
- Facilitate collection and analysis of information
  - Clarify and announce *policies for protecting information and those who provide it*
  - Encourage other industry participants to do the same
- Recognize that *compliance* is very important, but the *mission is reducing systemic risk*

# External Factors (con't): The Manufacturer's Role

Some aircraft manufacturers seek input, from the earliest design phases, from

- *Pilots* (User Friendly)
- *Mechanics* (Maintenance Friendly)
- *Air Traffic Services* (System Friendly)



# **Conclusions**

- A properly structured collaborative safety improvement process includes all SMS elements**
- The industry-level collaboration success provides a model for collaboration at the operator level**
- The regulator plays a key role in enabling operator creation of a collaborative process**
- Manufacturers can also play a role in improving an operator's collaborative process**

**Thank You!!!**



*Questions?*